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ABSTRACT

This in-depth case study investigated the deliberate attempt to infuse a multicultural perspective throughout a science methods course required of all intending elementary teachers at a major research university. Intending teachers' perspectives of being inducted into a profession overtly signifying its commitment to multicultural awareness and action were documented during multicultural activities, class discussions, guided individual journal entries, group and individual semi-structured audiotaped interviews, and field notes taken during the 2-day a week school-based placement in multicultural settings. Data from an initial sample of 40 preservice teachers were analyzed through standard qualitative techniques to generate insights for science teacher educators. Implications for science teacher education focus on two assertions: the evolutionary aspect of multicultural awareness among intending elementary science teachers and the crucial influence of the science methods instructors. Appendix A contains journal writing questions, and Appendix B contains the study survey. Appendixes labeled E, F, and G contain interview protocols. (Contains 16 references.) (Author/SLD)

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Researching The Induction of Intending Elementary Science Teachers In Multicultural Settings: The Science Methods Component

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Abstract

This in-depth case study investigated the deliberate attempt to infuse a multicultural perspective throughout a science methods course required of all intending elementary teachers at a major research university. Intending teachers' perspectives of being inducted into a profession overtly signifying its commitment to multicultural awareness and action were documented during multicultural activities, class discussions, guided individual journal entries, group and individual semi-structured audio-taped interviews, and field notes taken during the two-day a week school-based placement in multicultural settings. Data were analyzed through standard qualitative techniques to generate insights for science teacher educators. Implications for science teacher education focus on two assertions: the evolutionary aspect of multicultural awareness among intending elementary science teachers, and the crucial influence of the science methods instructor.

Introduction

Induction is the planned and organized orientation to the demands and responsibilities of teaching (Ashburn, 1987). Typically, the focus of the induction of teachers is the first year of full-time teaching (Burden, 1982) or the first few beginning years of employment (Huling-Austin, 1988). However, inducting new practitioners into the teaching of elementary science (a subject identified by the majority of intending elementary teachers as being exceptionally threatening due to their lack of content confidence) (Baker & Saul, 1994, p.1023) while also inducting them into multicultural settings (another area intending teachers perceive as threatening due to their lack of cultural confidence) can begin during the teacher preparation program. In this study, the argument is made that a more complete documentation of the "induction" of elementary teachers of science *into multicultural settings* begins by examining their beliefs and attitudes during their science methods course which focuses on the teaching of science to diverse young learners. Subsequent on-going studies will document intending elementary teachers of science development in this area of interest during their student teaching and their first few years of full-time employment. This type of research study is of considerable current interest as researchers strive to document intending teachers movement from "peripheral" participation (Lave, 1992) to full-fledged participation in teaching, particularly in multicultural settings (Larke & Bradley, 1990; Nel, 1993; Reed, 1993).

Methods

The interpretative research methods employed in this study were guided by Erickson (1986). The intent was to focus on "the meanings of actions, as defined by the actors' points of view" (p.119). It was conducted within a constructivist paradigm which was guided by an associated set of ontological, epistemological, and methodological beliefs (Guba & Lincoln, 1989). Namely, as principal investigators, we assumed that there are multiple realities which can be socially constructed, ours would be but one. And, we believed that our findings would be knowledge claims or constructions which

would we would negotiate among ourselves by using the data we collected in the setting in which we worked.

Study Site and Participants

The site of this investigation into the perspectives of forty intending elementary science teachers on their preparedness to teach multicultural education was an elementary science methods course taught in the spring, 1994 and the fall, 1994 by one of the principal investigators of this study (McGinnis) at a major American research university in the Mid-Atlantic Region of the United States. The participants were enrolled in the course, one of five required methods courses which the intending teachers take as a "Block" during the same semester. The course included university instruction twice a week on campus and a two-day a week internship in public elementary schools. The elementary schools in which the science methods interns were placed were selected for use by the university upon consideration of many criteria, one being that they included significant representation of students of diverse backgrounds (African-American, Euro-American, Hispanic).

The intending elementary teachers voluntary participating in this study represented diverse groups (ethnic, gender, religion, and SES). In cohort #1 (those enrolled in the spring, 1994 class) there was one male student and nineteen female intending teachers. They described themselves as members of a range of religions (including Judaism, Christianity, and Islam) and representing a range of socio-economic levels. In cohort #2 (those enrolled in the fall, 1994 class and identified in this paper with a letter and a ') there were twenty female intending teachers. Once again, the students described themselves as diverse in ethnic, religious, and socio-economic backgrounds. The white male science methods instructor and the female African American doctoral student in education were the principal investigators and data collectors in this research study.

Data Sources

The participants of this study engaged in a variety of data gathering techniques throughout the semester they were enrolled in science methods. Instances of data collection are described below.

Participants wrote their responses (reflections) to instructor directed journal questions concerning the importance of infusing multicultural education into the elementary science curriculum throughout the semester. These questions are included in appendix A. All participant responses were photocopied and collected for analysis.

The participants engaged in a mandatory beginning of the semester multicultural education workshop which took as its focus a sharing of their heritage, diversity, and personal interest in science. Participants were asked to complete a survey at the beginning of the workshop. This survey is presented in appendix B. During the workshop, participants responded to questions asking them to share information on their backgrounds. These questions are included in appendix C. They presented their responses in small group poster displays that were collected for later analysis. Upon completion of the workshop, participants completed another survey which is included in appendix D.

During the semester, a sample of the participants (individual and small group) were interviewed at the beginning, middle, and end of term. The interviews used three semi-structured protocols and were audio-taped and transcribed. The questions focused on their perspectives of infusing multicultural education throughout the science curriculum. A copy of the interviews are included in appendices E, F, and G.

Ongoing comments made during discussions and during science microteaching experiences in the science methods class were noted and recorded by the instructor and another researcher invited into the class by the instructor. These notes were included in the analysis of data.

During a class session on "Multicultural education and science teaching" participants drew their individual vision of a "scientist" and

described that drawing to the class. These drawings were collected and included in the analysis of data.

Participants were observed throughout the semester in their two-day a week elementary school placements. Field notes of those observations were also included in the data analysis.

Data Analysis and Interpretation

Data were analyzed throughout the study by the principal investigators. The analysis and interpretation process consisted of reading and examining collected data (survey responses, journal entries, field notes, and participant artifacts) and formulating tentative assertions that were negotiated among the principal investigators. These tentative assertions were then tested by many sources in the data set. This iterative process of phases of interpretation, critique, and re analysis became a hermeneutic cycle that resulted in the emergence of joint constructions of one possible view of the intending teachers' discussion and actions during their science methods class.

Preliminary analysis of the wealth of data indicated that there were regularities in the science methods students attitudes, beliefs, and performances related to multicultural education. In the sections below, selected participants' voices are presented in support of two assertions emerging from this study:

(a) *the evolutionary aspect of multicultural awareness among intending elementary science teachers*, and
(b) *the crucial influence of the science methods instructor in legitimizing a multicultural perspective in science teaching.*

Assertion One: *Multicultural awareness among intending elementary teachers of science proceeds in an evolutionary fashion.*

Multicultural education is an educational initiative that is viewed through lenses of need by intending teachers of science. Easy entrance to multiculturalism, a concept for which exists no univocal definition at this time (see, Grant & Sleeter, 1985; Garcia & Pugh, 1992; Green, 1992; Atwater, 1993) for the intending elementary

teacher of science involves a non-discriminatory notion--no learner is overtly discriminated against by the teacher in social actions. Moving toward the need to reflect on how one's teaching practice impacts students differently depending on their backgrounds, an awareness of the importance of individual student learning preferences, and the development of an interception body of teaching practice that combines science content with an understanding and appreciation of learners' diverse backgrounds is a slow and arduous journey for the majority of intending elementary teachers of science. For many, the process is just starting by the end of their science methods course.

Intending teachers' voices presented in telling episodes:

Beginning of semester(s):

Episode 1
How do you feel about the likelihood of teaching elementary school science in classrooms with diverse populations--many of whom will not share your ethnicity or background?

Student E:
I 'm not sure it really affects my teaching, because I think that I would be teaching the same curriculum no matter what. The major concepts would still be there, no matter what the ethnic backgrounds. (3/9)

Episode 2:

What do you believe you should know to succeed in teaching elementary school science in classrooms with diverse populations?

Student A:
I think it is important in teaching science to present them with different ways of receiving information. *I don't know if it is so much related to cultural background* but it can very well be. (3/9)

Student B:
I think that science has to be hands on for everyone. (3/9)

Student C:
I think you have to have a science background. As far as the diverse populations, I don't see it directly affecting it. (3/9)

Student D:
I haven't thought about that much. In doing my lesson plans and thinking about the multicultural aspect of things is a brand new thing to me. It takes me a while to process this and I'm not sure, or maybe on a month I'll have a better answer. I just don't know. (3/9)

Student A':
I think science is a hard subject to integrate other cultures, so I would integrate other subjects. I think personally that science is hard by itself, just the basics of science without including anyone else's background. (10/26)

Episode 3:

Discuss what is said about teaching diverse populations by the school personnel in the school in which you are interning two days a week and what you see taking place.

Student A:
I don't hear too much talk about it, in fact I don't know that I have at all. To be honest I haven't seen any science taking place, period. Not even for five minutes....(3/9)

Student B:
Basically I have seen one science lesson since I've been there - it was completely book driven and the students did not seem particularly interested in it. In terms of cultural diversity, I haven't heard any of the teachers speak about that in particular. The school is majority African-American with some Hispanic, I haven't seen any Asian students and some Caucasian so I don't know if they are trying to take a view of cultural diversity because they have a majority of minority, typical minority. *It's never been mentioned* [italics added]. (3/29)

Student C:
I haven't heard anything said and at this point, they really haven't done anything. So it's really not there.
Describe the things you see yourself doing in your future elementary school classroom to succeed in teaching elementary school science to kids from diverse backgrounds. (3/9)

Student D:
I haven't heard anything. I haven't noticed anything. (3/9)

Student F:
I have not discussed it with anybody. (3/9)

Episode 4:

Describe the things you see yourself doing in your future elementary school classroom to succeed in teaching elementary school science to kids from diverse backgrounds.

Student A:
Okay, I see myself providing a wide variety of materials for students to have easy access to. (3/9)

Student B:
I can see myself having resources in the classroom, that I don't usually see in schools like the *Discover* magazine for children. (3/9)

Student E:
A lot of hands on experiences. Because I think when you talk about different backgrounds, different ethnic groups, there is going to be a language difference and I think that the kids will learn more from seeing it versus hearing it.

Toward the End of the Semester(s):

Episode 5:

From your perspective at this time, what do you see yourself doing during your upcoming student teaching experience and next year when you are employed as a full time elementary teacher that demonstrates that you can teach science to all students?

Student A:
I want to just pull it all in. If you use groups, than that contributes to multiculturalism as well. It contributes because that students not only get their own view points, but they get the view points of others as well. (5/12)

Student B:
The biggest lesson that I have learned this semester is how other people work in cooperative groups. I think it has broaden my perspective because I have been able to see how and what other people are thinking. This is the first time that I have been able to see cooperative learning done and done correctly. (5/12)

Student J':
The biggest thing that we have learned is that all students learn differently. I think it is important to recognize that all students learn differently and this may not be due to the fact that they are from different cultures, but that's what we are talking about how. I think that making activities that allow students to interact with each other. I would provide different types of activities for students there are some students who learn visually and those who learn through hands-on and there are those who learn orally, I would provide these students with different ways of learning. Providing a wide variety of ways to asses children would be beneficial. I think that I will approach every child with the potential of being multicultural. In my eyes, every child is different. I would provide them with as many different ways to interact as I can. I would encourage students to bring different things to the classroom. There are a lot of students from different countries, I would encourage those students to bring those different things that they know to the science class. For example there are some people who live

on the Nile and they do things differently. These students should be encouraged to bring their differences the classroom. (12/5)

Student T':
I think science should be the same for everyone. I feel that since multiculturalism is the wave of the future, then if I must hop on the wave, I must focus on developments in science and where they originated. If I have children from the Middle East, then I have to focus on things that developed in the Middle East. I have to try to make it meaningful for the students by addressing their own heritage in science. (5/12)

Student A':
I want to make it come naturally. I want us to incorporate constructivism into what I do. By incorporating constructivism into our t teaching science, it will just be natural that multiculturalism will be incorporated. Constructivism enhances multiculturalism in the classroom by making things hands-on and by making kids live science, and experience science for themselves.

Episode 6:

How do you feel about the likelihood of teaching elementary school science in classrooms with diverse populations many of whom will share your ethnicity or background?

Student V':
I am a social studies concentration, and this week, I taught science. I just had to think about every kid and what they knew. We were doing animals and vertebrates. I was thinking about how to multiculturalize it a little. It's hard, because there are not material out there. I had to use my own background. I brought in something that I new from my own background. I am Hispanic. I told the kids that in my culture, we eat guinea pigs, they are a delicacy. They were like wow, what did they taste like? We went into it for about ten minutes. It takes a little time out of the way, but they learned from it also. It gave them a wider knowledge base. It's hard to do. (12/5)

Student C:
I think that it's great. I am very interested in multicultural education. I like reading books and literature about m/c, I like top read about different races, cultures, and ethnicity. I think if we don't do that the children, all children are missing out on a lot of things, if you don['t share other cultures with them. (12/5)

Episode 7:

What do you believe you should know to succeed in teaching elementary school science in classrooms with diverse populations?

Student C':
Basically their backgrounds. (12/5)

Student V:
Again, backgrounds I think that's important. Also I think that it is important to have background knowledge in a subject that you decide that you want to teach.. Now I kind of regret being a social studies concentration because I really like teaching science. I think that teachers really have to know background because the students will come up with all kinds of questions. (12/5)

Student C':
I would try to know how to connect the two. I want to know about the background of these children, where they come from, their beliefs and values and how I can make my science lessons more interested to them by including multicultural aspects.(12/5)

Episode 8:

Discuss what is said about teaching diverse populations by the school personnel in the school in which you are interning two days a week and what you see taking place.

Student D:
What you see in [my school placement] is just multiculturalism and success of the black male, but when you get inside of that

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classroom, it's a whole different story. There is this new African-American little girl who have came into the school. The teachers were all gathered around in the lunch room. I was just sitting there and they were talking about how terrible, awful, and nasty this little girl was. As the were saying this, they were also talking about how bright this little girl was. I suggested that she could be afraid and putting up an front. They looked at me as if to say who are you little block method student to tell me that I am wrong. Then they proceeded back to there nastiness. I made friends with her and she is just wonderful to me. All the students that they have trouble makers will do things for me that they won't do for other teachers. Some teachers label the kids and the kids live out their labels. (12/5)

Student J':
While we don't treat the students differently, you should vary your teaching styles so that you hit all of the different learning styles. In these courses, we discuss multiculturalism often, but as college students I think that in a classroom it was not discussed. You have to live multiculturalism, it must come naturally. (12/5)

Assertion Two: *The science methods instructor served a crucial influence in infusing the need for a multicultural perspective in the intending teachers' teacher preparation program.*

The foremost concern that beginning intending elementary teachers of science bring to their science methods course is the need for science content enhancement. The importance of studying how to teach students of diverse backgrounds, if it exists at all, is subsidiary to this driving need. To legitimize the additionally important need to gain skills and knowledge to successfully teach students of diverse backgrounds, the science methods instructor is crucial. Intending teachers look to the instructor as a standard-bearer of science education. If the instructor holds the belief that the successful teaching of science requires a multicultural awareness and knowledge base, intending teachers are willing to acknowledge the issue as legitimate and tentatively consider it as a meaningful factor

in their acculturation of science teaching that is effective and research-based.

Intending teachers' voices presented in telling episodes:

Episode 1:

Describe the things you see yourself doing in your future elementary school classrooms to succeed in teaching elementary school science to kids from diverse backgrounds.

Student A'
Call Dr. McGinnis. I would ask a lot of questions. I would ask everybody everything that comes to my head. I would definitely ask questions. I want the atmosphere that when a child walks into my classroom, no matter what culture they are from I want them to be able to connect with something. I want them to walk in and see something familiar, or see some thing that they can identify with in that classroom. With science you teach it in the classroom, the atmosphere has to be open. I think with some science lesson, you can bring in the nationality of the scientist and who said what. You can bring in some names if you know them. (10/26)

Episode 2:

Any final comments to share on the issues of teaching diverse elementary students science after this semester in the science methods?

Student G:
If you asked me two years from now, this semester would stand out. There has probably been a lot of classes but none of it stuck. Everything we talked about this semester [in science methods] dealt with multiculturalism. (5/12)

Episode 3:

Student T':
I feel that the science [methods] presented us with perhaps a model or an experience that we can reflect back on in areas

that we can improve on or ideas that we gain by watching Dr. McGinnis try to approach it multiculturally. I think we can expand upon his ideas. (5/12)

Student J':
I think that the science methods course was presented to us in the way that we should teach. If the examples that I saw in this course is what I see. I also think it came it form the background that we all have. *I see this courses as a model of what a science class should be like.* [italics added]. (5/12)

Episode 4:

Looking back over the entire semester, what specific lectures/activities/discussions can you identify in which you considered multicultural education in this class?

Student J':
We had the multicultural seminar, it really made us focus. It put it in our heads. Then there was the micro-teaching. It wasn't really the focus but it was addressed. With our reflection sheet, when we evaluated our micro-teaching; where we were supposed to talk about multicultural ed and how each lesson applied and fitted into multicultural education. That made us think about it. (5/12)

Episode 5:

Before the methods block, did any other education classes focus in on multicultural education? If so , were there similarities or differences in how it was done compared with your science method's class?

Student J'
I don't think that we dealt with multiculturalism at all. (5/12)

In Conclusion and Implications

The research presented in this study is one component (the science methods experience) of a longitudinal study that has its goal to document and interpret the preparation of intending elementary teachers of science in their science methods class, their student

teaching semester, and their first few years of teaching. This kind of study can meet several needs that exist in science education. The first need is to systematically document the attitudes, beliefs, and performances of intending elementary teachers of science toward teaching diverse students. The second need is to systematically document the impact of efforts to infuse multicultural education in the preparation of elementary science teachers.

Implications for this chapter in the story of the induction of elementary teachers of science in multicultural settings are seen at this point in the research study to be twofold. Firstly, intending teachers bring to their science methods' course multiple perspectives on teaching science to diverse students. Their beliefs range from treat all kids the same (universalism) to a willingness to acknowledge the impact of diverse backgrounds on the teaching of science (multiculturalism). Intending elementary teachers' attitudes toward the infusing of multicultural education in science teaching range from extremely negative (no need for it) to extremely positive (it is crucial) Secondly, intending elementary teachers of science look to their science teacher educator to alert them to the demands of teaching science. If a cogent argument for a multicultural perspective in science education can be made by the instructor through activities and discussion, and if the intending teachers have field-based experiences in settings characterized by students of diverse backgrounds and then are given opportunities to engage in reflection on the impact of student diversity on instruction the need to gain skills and competencies that specifically address the goal to better teach students of diverse backgrounds is legitimized. As cogently stated in 1979 by Rose, Lockard, and Paldy, "The teacher is the key." It appears that in the effort to infuse multicultural education in science teacher preparation, this is particularly true for elementary science teacher educators.

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Appendix A
Journal Writing Questions

Week Two
After spending a day in my assigned school, what have I noticed about the diversity of the student population in my classroom? How do I anticipate how that will influence my science teaching in that environment?

Week Eight
The challenge in science teaching is to make science as inclusive as possible to better teach all students. What are my thoughts on including a section in every science lesson plan, a "Diversity Component" [similar to the micro-teaching reflection item that asked if the lesson had multicultural considerations], that calls on me to plan ahead to make the science lesson's topic inclusive?

Week Eleven:
From my perspective, who exactly makes up a "multicultural" population and what do I need to know about them to teach elementary science successfully?

Appendix B

Survey: Multicultural Education and Science Teaching

1. What do you think of when you hear multicultural education?
2. Who do you think benefits from multicultural education?
3. Do you see any role of multicultural education in science teaching?

Appendix E
Interview Protocol #1: Science Methods Students

Questions:
a. [attitude]

1. How do you feel about the likelihood of teaching elementary school science in classrooms with diverse populations--many of whom will not share your ethnicity or background?

b. [beliefs]

2. What do you believe you should know to succeed in teaching elementary school science in classrooms with diverse populations?

c. [behavior]

3 Describe the things you see yourself doing in your future elementary school classroom to succeed in teaching elementary school science to kids from diverse backgrounds.

[social contextual]

4. Discuss what is said about teaching diverse populations by the school personnel in the school in which you are interning two days a week and what you see taking place.

Appendix F

Interview Protocol #2: Science Methods Students

1. (Graduate Research Assistant): From my observation of your teaching experience in the schools this semester, I observed that you seemed to treat all your diverse students the same. What then does a focus of multicultural education in your college science methods class offer you as a future practicing elementary teacher?

[probe: Where do you see this type of educational initiative (multicultural education) in 5 years?]

2. (Instructor of Science Methods Class): In your science methods class, two themes I wanted to emphasize were multicultural education and constructivism. Do you think there is any connection between those two ideas?

[probe: Elaborate on your conclusion]

3. (Instructor of Science Methods Class): [My graduate research assistant] and I have certainly asked you some probing questions about your science methods class this semester. We wonder if you have any final comments to add?

Appendix G

Interview Protocol #3 : Science Methods Students

1. Throughout this semester in Elementary Science Methods, multicultural education has been one theme you have investigated. Looking back over the entire semester, what specific lectures/activities/discussions can you identify in which you considered multicultural education in this class?

2. Did any of your other subject matter methods classes this semester also focus in on multicultural education? If so, were there similarities/differences in how it was done compared with your science method's class?

3. Before the methods block, did any other education classes focus in on multicultural education? If so, were there similarities/differences in how it was done compared with your science method's class?

4. From your perspective at this time, what do you see yourself doing during your upcoming student teaching experience and next year when you are employed as a full time elementary teacher that demonstrates that you can teach science to all students?

5. Any final comments to share on the issues of teaching diverse elementary students science after this semester in the science methods?